Agenda

Kim Perez
Stakeholder Engagement and Policy Specialist

2016-2017 Transmission Planning Process Stakeholder Meeting
February 29, 2016

2016-2017 Draft Study Plan Stakeholder Meeting - Today's Agenda

Topic	Presenter
Opening	Kim Perez
Transmission Planning Process Overview	Chris Mensah-Bonsu
Transmission Cycle Key Issues	Neil Millar
Reliability Assessment	Binaya Shrestha
Local Capacity Requirement (LCR) Studies - Near-Term - Long-Term	Catalin Micsa
Special Studies - Gas-Electric Coordination - Required Performance Characteristics for Slow Response Local Capacity Resources - 50% Renewable Special Study - Frequency Response – Generation Modeling - Potential for Economically-Driven Retirement of Gas Generation	Robert Sparks Jeff Billinton
Economic Planning Study	Yi Zhang
Next Steps	Chris Mensah-Bonsu

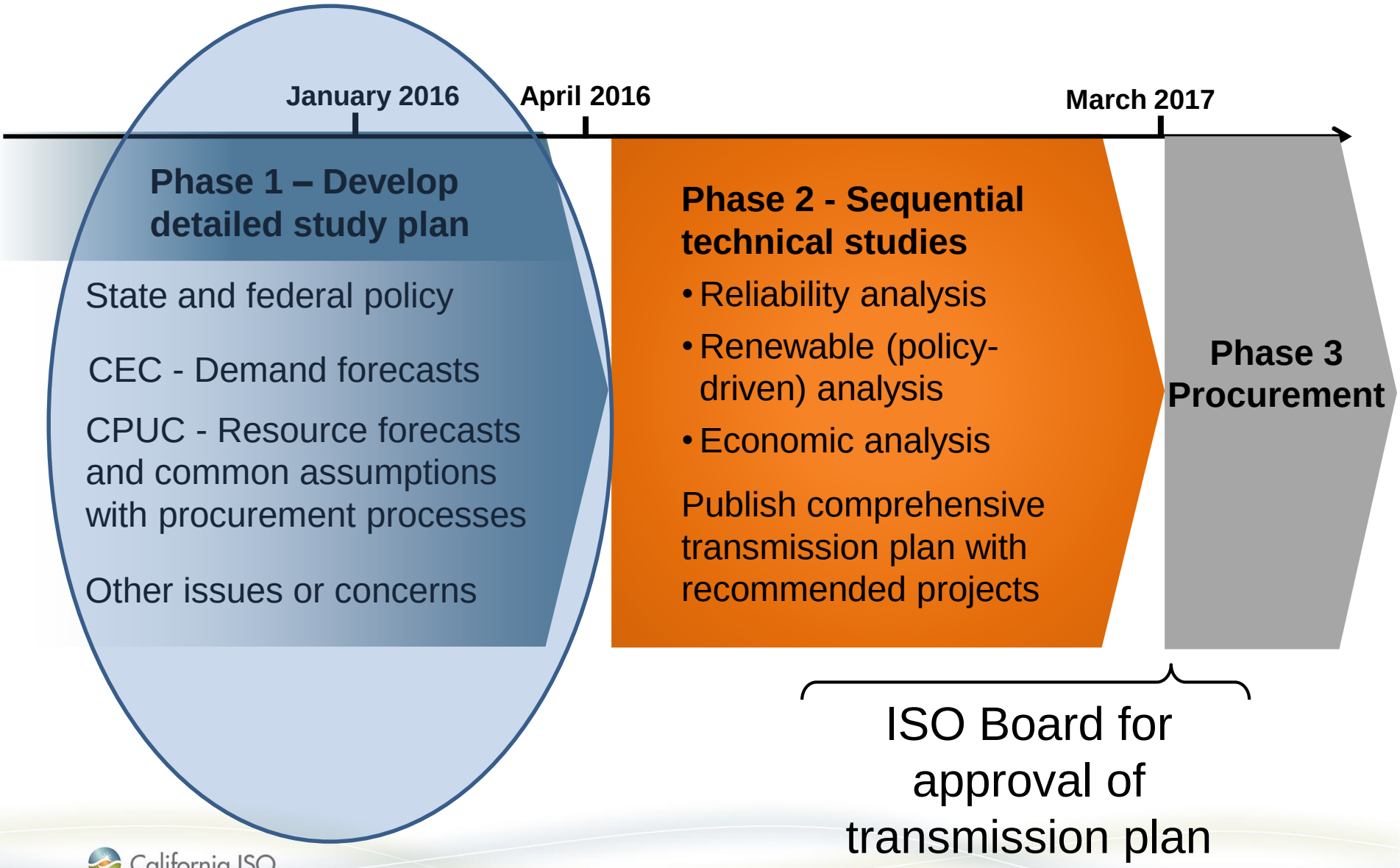
Unified Planning Assumptions & Study Plan
Transmission Planning Process Overview

Chris Mensah-Bonsu
Lead Regional Transmission Engineer

2016-2017 Transmission Planning Process Stakeholder Meeting

February 29, 2016

2016-2017 Transmission Planning Process



Schedule and Milestones

Phase	No	Due Date	2016-2017 Activity
Phase 1	1	December 15, 2015	The ISO sends a letter to neighboring balancing authorities, sub-regional, regional planning groups requesting planning data and related information to be considered in the development of the Study Plan and the ISO issues a market notice announcing a thirty-day comment period requesting demand response assumptions and generation or other non-transmission alternatives to be considered in the Unified Planning Assumptions.
	2	January 15, 2016	PTO's, neighboring balancing authorities, regional/sub-regional planning groups and stakeholders provide ISO the information requested No.1 above.
	3	February 22, 2016	The ISO develops the draft Study Plan and posts it on its website
	4	February 29, 2016	The ISO hosts public stakeholder meeting #1 to discuss the contents in the Study Plan with stakeholders
	5	February 29 - March 14, 2016	Comment period for stakeholders to submit comments on the public stakeholder meeting #1 material and for interested parties to submit Economic Planning Study Requests to the ISO
	6	March 31, 2016	The ISO specifies a provisional list of high priority economic planning studies, finalizes the Study Plan and posts it on the public website
	7	Q1	ISO Initiates the development of the Conceptual Statewide Plan

Schedule and Milestones (continued)

Phase	No	Due Date	2016-2017 Activity
Phase 2	8	August 15, 2016	The ISO posts preliminary reliability study results and mitigation solutions
	9	August 15, 2016	Request Window opens
	10	September 15, 2016	PTO's submit reliability projects to the ISO
	11	September/October 2016	ISO posts the Conceptual Statewide Plan on its website and issues a market notice announcing the posting
	12	September 21 – 22, 2016	The ISO hosts public stakeholder meeting #2 to discuss the reliability study results, PTO's reliability projects, and the Conceptual Statewide Plan with stakeholders
	13	September 22 – October 6, 2016	Comment period for stakeholders to submit comments on the public stakeholder meeting #2 material
	14	October 15, 2016	Request Window closes
	15	October/November 2016	Stakeholders have a 20 day period to submit comments on the Conceptual Statewide Plan in the next calendar month after posting conceptual statewide plan (i.e. August or September)
	16	October 28, 2016	ISO post final reliability study results
	17	November 14, 2016	The ISO posts the preliminary assessment of the policy driven & economic planning study results and the projects recommended as being needed that are less than $50 million.
	18	November 16, 2016	The ISO hosts public stakeholder meeting #3 to present the preliminary assessment of the policy driven & economic planning study results and brief stakeholders on the projects recommended as being needed that are less than $50 million.
	19	November 16 – November 30, 2016	Comment period for stakeholders to submit comments on the public stakeholder meeting #3 material
	20	December 14 – 15, 2016	The ISO to brief the Board of Governors of projects less than $50 million to be approved by ISO Executive
	21	January 2017	The ISO posts the draft Transmission Plan on the public website
	22	February 2017	The ISO hosts public stakeholder meeting #4 to discuss the transmission project approval recommendations, identified transmission elements, and the content of the Transmission Plan
	23	Approximately three weeks following the public stakeholder meeting #4	Comment period for stakeholders to submit comments on the public stakeholder meeting #4 material
	24	March 2017	The ISO finalizes the comprehensive Transmission Plan and presents it to the ISO Board of Governors for approval
	25	End of March, 2017	ISO posts the Final Board-approved comprehensive Transmission Plan on its site

Schedule and Milestones (continued)

Phase	No	Due Date	2016-2017 Activity
Phase 3	26	April 1, 2017	If applicable, the ISO will initiate the process to solicit proposals to finance, construct, and own elements identified in the Transmission Plan eligible for competitive solicitation

Note: The schedule for Phase 3 will be updated and available to stakeholders at a later date.

2016-2017 Transmission Planning Process Study Plan

- Reliability Assessment to identify reliability-driven needs
- Local Capacity Requirements
  - Near-Term; and
  - Long-Term
- Policy Driven 33% by 2020 RPS Transmission Plan Analysis
  - Achieving 33% renewable energy on an annual basis
  - Supporting RA deliverability status for needed renewable resources outside the ISO
- Special Studies
- Economic Planning Study to identify needed economically-driven elements
- Long-term Congestion Revenue Rights
- Interregional Transmission Projects

Study Information

- Final Study Plan will be published March 31st
- Base cases will be posted on the Market Participant Portal (MPP)
  - For reliability assessment in Q3
  - For 33% renewable energy assessment in Q4
- Market notices will be sent to notify stakeholders of meetings and any relevant information
- Stakeholder comments
  - Stakeholders requested to submit comments to: regionaltransmission@caiso.com
  - Stakeholder comments are to be submitted within two weeks after stakeholder meetings
  - ISO will post comments and responses on website

Coordination of input assumptions with state agencies

- Coordinated with CEC and CPUC:
  - CEC 2015 Integrated Energy Policy Report
    - California Energy Demand Updated Final Forecast 2016-2026
  - Continued coordination between TPP and CPUC LTPP
    - CPUC draft Planning Assumptions & Scenarios Update For The 2016 Long Term Procurement Plan Proceeding And The CAISO 2016–17 Transmission Planning Process
    - http://docs.cpuc.ca.gov/SearchRes.aspx?docformat=ALL&docid=158117030

Key Issues influencing the 2016-2017 Study Plan
Transmission Planning Process

Neil Millar

Executive Director, Infrastructure Development

2016-2017 Transmission Planning Process Stakeholder Meeting

February 29, 2016

Coordination of input assumptions with California Energy Commission and Public Utilities Commission

- CEC 2015 Integrated Energy Policy Report
  - California Energy Demand Updated Final Forecast 2015-2025
- Continued coordination between Transmission Planning Process and CPUC's LTPP still underway
- ISO anticipates receiving the RPS portfolios for 2015-2016 transmission planning process from the CPUC/CEC in February/March
  - The ISO anticipates that the existing 33% RPS scenarios will continue to be used until direction is available on 50% RPS goals – likely 2017-2018 or possibly 2018-2019

California's Senate Bill 350 – Clean Energy and Pollution Reduction Act of 2015 – sets new stage

- Signed into law on October 7, 2015, SB350 would reduce GHG emissions through a 50% RPS by 2030
- Directs the ISO to "expeditiously" develop, through specific requirements, a set of proposed modifications to its governance structure that if instituted, would allow the ISO to transform into a "regional organization"
- Provides California opportunities to consider renewable resources across the broader western landscape
- Promotes collaborative effort among the ISO and state energy agencies to explore informational analysis to understand potential transmission implications of increased grid connected renewable generation

New initiatives are underway that will set the course for achieving SB 350 renewables goals

- The CPUC and CEC, with the help of other state agencies and the ISO has launched RETI 2.0.
- California understands that outreach to the broader western renewable landscape is a likely and necessary step to achieve its 50% energy goal
  - Preliminary ISO studies indicate significant value in increased geographic and resource diversity
- RETI 2.0 seeks opportunities to consider renewable resources throughout the West that could provide a “best fit” for California’s renewables need
- The FERC Order No. 1000 interregional coordination process provides a forum for collaboration with neighboring planning regions

Areas of emphasis expected in 2016-2017 cycle:

- Addressing higher levels of renewable generation
  - Initiating interregional coordination of consideration of interregional projects supporting geographic and resource diversity as part of 50% RPS considerations
  - Modeling improvements to enhance frequency response analysis
  - Potential for increased economically driven retirement of gas fired generation
- Further consideration of preferred resource characteristics – especially slow response resources
- Expanding on gas-electric coordination analysis
- Support increased challenges in load forecasting given behind the meter emerging issues.

Unified Planning Assumptions & Study Plan
Reliability Assessment

Binaya Shrestha
Regional Transmission Engineer Lead

2016-2017 Transmission Planning Process Stakeholder Meeting
February 29, 2016

Planning Assumptions

- Reliability Standards and Criteria
  - California ISO Planning Standards
  - NERC Reliability Criteria
    - TPL-001-4
    - NUC-001-2.1
  - WECC Regional Criteria

Planning Assumptions
(continued)

- Study Horizon
  - 10 years planning horizon
    - near-term: 2017 to 2021
    - longer-term: 2022 to 2026

- Study Years
    - near-term: 2018 and 2021
    - longer-term: 2026

Study Areas

- **Northern Area - Bulk**
- **PG&E Local Areas:**
  - Humboldt area
  - North Coast and North Bay area
  - North Valley area
  - Central Valley area
  - Greater Bay area:
  - Greater Fresno area;
  - Kern area;
  - Central Coast and Los Padres areas.
- **Southern Area – Bulk**
- **SCE local areas:**
  - Tehachapi and Big Creek Corridor
  - North of Lugo area
  - East of Lugo area;
  - Eastern area; and
  - Metro area
- **SDG&E area**
  - Bulk transmission
  - Sub-transmission
- **Valley Electric Association area**

Transmission Assumptions

- Transmission Projects
  - Transmission projects that the ISO has approved will be modeled in the study
- Reactive Resources
  - The study models the existing and new reactive power resources in the base cases to ensure that realistic reactive support capability will be included in the study
- Protection Systems
  - The major new and existing SPS, safety nets, and UVLS that will be included in the study
- Control Devices
  - Several control devices were modeled in the studies

Load Forecast Assumptions

Energy and Demand Forecast

- California Energy Demand Updated Final Forecast 2016-2026 adopted by California Energy Commission (CEC) on January 27, 2016 will be used:
    - Using the Mid Case LSE and Balancing Authority Forecast spreadsheet of January 27, 2016

  – Additional Achievable Energy Efficiency (AAEE)
    - Consistent with CEC 2015 IEPR
    - Mid AAEE will be used for system-wide studies
    - Low-Mid AAEE will be used for local studies

  – CEC forecast information is available on the CEC website at:

http://www.energy.ca.gov/2015_energypolicy/documents/index.html#adoptedforecast

Load Forecast Assumptions

Energy and Demand Forecast (continued)

- The following are how load forecasts are used for each of the reliability assessment studies.
  - 1-in-10 load forecasts will be used in PG&E, SCE, SDG&E, and VEA local area studies including the studies for the LA Basin/San Diego local capacity area.
  - 1-in-5 load forecast will be used for bulk system studies

- Methodologies used by PTOs to create bus-level load forecast were documented in the draft Study Plan

Load Forecast Assumptions

Energy and Demand Forecast (continued)

- The CEC Energy and Demand Forecast states the following with respect to the impact of PV at the time of the forecast peak load:
- *"At some point, continued growth in PV adoption will likely reduce demand for utility-generated power at traditional peak hours to the point where the hour of peak utility demand is pushed back to later in the day. This means that future PV peak impacts could decline significantly as system performance drops in the later hours. This possibility has not been incorporated into the demand forecast through CED 2015, since staff has not yet developed models to forecast hourly loads in the long term. Staff expects to develop this capability for the 2017 Integrated Energy Policy Report (2017 IEPR), and such an adjustment to PV peak impacts could significantly affect future peak forecasts."*
- In the 2016-2017 TPP, the ISO will use the CEC energy and demand forecast for the base scenario analysis
- As the ISO conducts sensitivities on a case by case basis and to comply with the NERC TPL-001-4 mandatory reliability standard, these and other forecasting uncertainties will be taken into account in the sensitivity studies

Load Forecast Assumptions

Methodologies to Derive Bus Level Forecast

- The CEC load forecast is generally provided for the larger areas and does not provide the granularity down to the bus-level which is necessary in the base cases for the reliability assessment

- The local area load forecast are developed at the bus-level by the participating transmission owners (PTOs) .

- Descriptions of the methodologies used by each of the PTOs to derive bus-level load forecasts using CEC data as a starting point are included in the draft Study Plan.

Load Forecast Assumptions

Self-Generation

- PV component of the self-generation in the CEC demand forecast will be modeled as discrete element in the 2016-2017 TPP base cases.
  - Amount of the self-generation PV to be modeled will be based on 2015 IEPR data.
  - Location to model self-generation PV will be identified based on location of existing behind-the-meter PV and information from PTO on future growth.
  - Output of the self-generation PV will be selected based on the time of day of the study using the end-use load and PV shapes for the day selected.
  - Composite load model CMPLDWG will be used to model the self-generation PV.

Generation Assumptions

- One-year operating cases
- 2-5-year planning cases
    - Generation that is under construction (Level 1) and has a planned in-service date within the time frame of the study;
    - Conventional generation in pre-construction phase with executed LGIA and progressing forward will be modeled off-line but will be available as a non-wire mitigation option.
    - OTC repowering projects will be modeled in lieu of existing resources as long as they have power purchase approval from the CPUC or other Local Regulatory Agency (LRA)
    - CPUC's discounted core and ISO's interconnection agreement status will be utilized as criteria for modeling specific renewable generation
- 6-10-year planning cases
    - CPUC RPS portfolio generation included in the baseline scenario
- Retired generation is modeled in appropriate study areas

Generation Assumptions

Renewable Dispatch

- The ISO has done a qualitative and quantitative assessment of hourly Grid View renewable output for stressed conditions during hours and seasons of interest.
- Available data of pertinent hours was catalogued by renewable technology and location on the grid.
- The results differ somewhat between locations and seasons and was assigned to four areas of the grid: PG&E, SCE, SDG&E and VEA.

Generation Assumptions

Generation Retirements

- Nuclear Retirements
  - Diablo Canyon will be modeled off-line based on the OTC compliance date
- Once Through Cooled Retirements
  - separate slide below for OTC assumptions
- Renewable and Hydro Retirements
  - Assumes these resource types stay online unless there is an announced retirement date.
- Other Retirements
  - Unless otherwise noted, assumes retirement based resource age of 40 years or more.

Generation Assumptions

Announced/Requested Generation Retirements

PTO Area	Project	Capacity (MW)	First Year to be retired
SCE	El Segundo 3 (Scheduled to be retired when the El Segundo Power Redevelopment project is commercially available)	335	2013
	Huntington Beach 3 & 4 (retired and converted to synchronous condensers in 2013; modeled off-line post 2017 studies as contract expires)	450	2013
SDG&E	Kearny Peakers	136	2017
	Miramar GT1 and GT2	36	2017
	El Cajon GT	16	2017

Generation Assumptions

OTC Generation

Modeling of the once-through cooled (OTC) generating units follows the State Water Resources Control Board (SWRCB)'s Policy on OTC plants with the following exception:

- Generating units that are repowered, replaced or having firm plans to connect to acceptable cooling technology, as illustrated in Table 4.7-5 in the draft study plan; and
- All other OTC generating units will be modeled off-line beyond their compliance dates, as illustrated in Table 4.7-5, or per proposed retirements by the generation owners to proceed on repowering projects that have been approved by the state regulatory agencies.

Generation Assumptions

CEC permitted resources or CPUC-approved long-term procurement resources

PTO Area	Project	CEC Permitting Review Status	CPUC Long-Term Procurement Status	Capacity (MW)	First Year to be Modeled
SCE	Blythe Solar Energy Center (Under Construction) Units 1 & 2 Units 3 & 4	Approved with amendments	Approved	235 250	2017 2018
	Alamitos Energy Center	Under review	Approved	640	2020
	Huntington Beach Energy Project	Previously approved for larger project; under review for amendments	Approved	644	2020
SDG&E	Carlsbad	Previously approved; under review for amendments	Approved	500	2018
	Pio Pico Energy Center (Under Construction)	Approved	Approved	300	2017

Preferred Resources
Demand Response and Energy Storage

- Demand Response
  - Two scenarios:
    - One using the updated 20 minute DR data from SCE
    - The other consistent with the 2016 LTPP DR assumptions from the CPUC
  - Both the above scenarios would include the LSE-procured DR related to LTPP process
- Energy Storage
  - Amounts consistent with D.13-10-040
  - Not included in starting cases (no location data available), unless already procured by the LSEs as part of the LTPP process
  - Locational information provide by CPUC for PG&E and SCE areas
  - Identify most effective busses for potential development after reliability concerns have been identified

Major Path Flows and Interchange

Northern area (PG&E system) assessment

Path	Transfer Capability/SOL (MW)	Scenario in which Path will be stressed
Path 26 (N-S)	4,000	Summer Peak
PDCI (N-S)	3,100	
Path 66 (N-S)	4,800	
Path 15 (N-S)	-5,400	Summer Off Peak
Path 26 (N-S_	-3,000	
Path 66 (N-S)	-3,675	Winter Peak

Southern area (SCE & SDG&E system) assessment

Path	Transfer Capability/SOL (MW)	Target Flows (MW)	Scenario in which Path will be stressed
Path 26 (N-S)	4,000	4,000	Summer Peak
PDCI (N-S)	3,100	3,100	
West of River (WOR)	11,200	5,000 to 11,200	N/A
East of River (EOR)	9,600	4,000 to 9,600	N/A
San Diego Import	2,850	2,400 to 3,500	Summer Peak
SCIT	17,870	15,000 to 17,870	Summer Peak

Study Scenarios

Base Scenarios

Study Area	Near-term Planning Horizon		Long-term Planning Horizon
	2018	2021	2026
Northern California (PG&E) Bulk System	Summer Peak Spring Off-Peak	Summer Peak Spring Light Load	Summer Peak Spring Off-Peak
Humboldt	Summer Peak Winter Peak Spring Off-Peak	Summer Peak Winter Peak Spring Light Load	Summer Peak Winter Peak
North Coast and North Bay	Summer Peak Winter peak Spring Off-Peak	Summer Peak Winter Peak Spring Light Load	Summer Peak Winter peak
North Valley	Summer Peak Spring Off-Peak	Summer Peak Spring Light Load	Summer Peak
Central Valley	Summer Peak Spring Off-Peak	Summer Peak Spring Light Load	Summer Peak
Greater Bay Area	Summer Peak Winter peak - (SF & Peninsula) Spring Off-Peak	Summer Peak Winter peak - (SF & Peninsula) Spring Light Load	Summer Peak Winter peak - (SF Only)
Greater Fresno	Summer Peak Spring Off-Peak	Summer Peak Spring Light Load	Summer Peak
Kern	Summer Peak Spring Off-Peak	Summer Peak Spring Light Load	Summer Peak
Central Coast & Los Padres	Summer Peak Winter Peak Spring Off-Peak	Summer Peak Winter Peak Spring Light Load	Summer Peak Winter Peak
Southern California Bulk Transmission System	Summer Peak Spring Off-Peak	Summer Peak Spring Light Load	Summer Peak
Southern California Edison (SCE) area	Summer Peak Spring Off-Peak	Summer Peak Summer Light Load	Summer Peak
San Diego Gas & Electric (SDG&E) area	Summer Peak Spring Off-Peak	Summer Peak Spring Light Load	Summer Peak
Valley Electric Association	Summer/Winter Peak Summer Off-Peak	Summer/Winter Peak Summer Light Load	Summer/Winter Peak

Study Scenarios
Sensitivity Studies

Sensitivity Study	Near-term Planning Horizon		Long-Term Planning Horizon
	2018	2021	2026
Summer Peak with high CEC forecasted load	-	-	PG&E Local Areas SCE Metro SCE Northern SDG&E Bulk SDG&E Sub-transmission
Summer Peak with no behind-the-meter PV	-	-	PG&E Local Areas SCE Metro SCE Northern SDG&E Bulk SDG&E Sub-transmission
Summer Peak with heavy renewable output	-	PG&E Bulk PG&E Local Areas Southern California Bulk SCE Northern SCE North of Lugo SCE East of Lugo SCE Eastern SCE Metro SDG&E Bulk	-
Summer Off-peak with heavy renewable output (generation addition)	-	VEA Area	-
Diablo on-line	-	-	PG&E Bulk
Summer Peak with low hydro output	-	SCE Northern Area	-
Retirement of QF Generations	-	-	PG&E Local Areas

Study Base Cases

- WECC base cases will be used as the starting point to represent the rest of WECC

Study Year	Season	WECC Base Case
2018	Summer Peak	2018 HS3S
	Winter Peak	2015-16 HW3
	Summer Off-Peak	2016 LS1
	Spring Off-Peak	2017 LSP1SA
2021	Summer Peak	2021 HS2
	Winter Peak	2020-21 HW1
	Spring Light	2017 LSP1SA
2026	Summer Peak	2025 HS1
	Winter Peak	2026 HW1
	Spring Off-Peak	2026 LSP1
	Summer Partial Peak	2025 HS1

Contingencies

- **Normal conditions (P0)**

- **Single contingency (Category P1)**
  - The assessment will consider all possible Category P1 contingencies based upon the following:
    - Loss of one generator (P1.1)
    - Loss of one transmission circuit (P1.2)
    - Loss of one transformer (P1.3)
    - Loss of one shunt device (P1.4)
    - Loss of a single pole of DC lines (P1.5)

- **Single contingency (Category P2)**
  - The assessment will consider all possible Category P2 contingencies based upon the following:
    - Loss of one transmission circuit without a fault (P2.1)
    - Loss of one bus section (P2.2)
    - Loss of one breaker (internal fault) (non-bus-tie-breaker) (P2.3)
    - Loss of one breaker (internal fault) (bus-tie-breaker) (P2.4)

Contingencies
(continued)

- **Multiple contingency (Category P3)**
  - The assessment will consider the Category P3 contingencies with the loss of a *generator unit* followed by system adjustments and the loss of the following:
    - Loss of one generator (P3.1)
    - Loss of one transmission circuit (P3.2)
    - Loss of one transformer (P3.3)
    - Loss of one shunt device (P3.4)
    - Loss of a single pole of DC lines (P3.5)

- **Multiple contingency (Category P4)**
  - The assessment will consider the Category P4 contingencies with the loss of multiple elements caused by a stuck breaker (non-bus-tie-breaker for P4.1-P4.5) attempting to clear a fault on one of the following:
    - Loss of one generator (P4.1)
    - Loss of one transmission circuit (P4.2)
    - Loss of one transformer (P4.3)
    - Loss of one shunt device (P4.4)
    - Loss of one bus section (P4.5)
    - Loss of a bus-tie-breaker (P4.6)

Contingencies
(continued)

- **Multiple contingency (Category P5)**
  - The assessment will consider the Category P5 contingencies with delayed fault clearing due to the failure of a non-redundant relay protecting the faulted element to operate as designed, for one of the following:
    - Loss of one generator (P5.1)
    - Loss of one transmission circuit (P5.2)
    - Loss of one transformer (P5.3)
    - Loss of one shunt device (P5.4)
    - Loss of one bus section (P5.5)

- **Multiple contingency (Category P6)**
  - The assessment will consider the Category P6 contingencies with the loss of two or more (non-generator unit) elements with system adjustment between them, which produce the more severe system results.

- **Multiple contingency (Category P7)**
  - The assessment will consider the Category P7 contingencies for the loss of a common structure as follows:
    - Any two adjacent circuits on common structure14 (P7.1)
    - Loss of a bipolar DC lines (P7.2)

Contingencies

Contingency Event Table Comparison

New Category	Old Category	Description
P0	Cat A	System intact
P1	Cat B	Single contingency (Fault of a shunt device- fixed, switched or SVC/STATCOM is new)
P2	Cat C1, C2	Single event which may result in multiple element outage. Open line w/o fault, bus section fault, internal breaker fault
P3	Cat C3[1]	Loss of generator unit followed by system adjustments + P1. No load shed is allowed
P4	Cat C	Fault + stuck breaker events
P5	n/a	Fault + relay failure to operate (new)
P6	Cat C3	Two overlapping singles (not generator)
P7	Cat C5, C4	Common tower outages; loss of bipolar DC

1. Loss of generator unit followed by system adjustment + line outage was and ISO Category B

Contingency Analysis
(continued)

- **Extreme contingencies (TPL-001-4)**
  - As a part of the planning assessment the ISO assesses Extreme Event contingencies per the requirements of TPL-001-4;
    - however the analysis of Extreme Events will not be included within the Transmission Plan unless these requirements drive the need for mitigation plans to be developed.

Technical Studies

- The planning assessment will consist of:
  - Power Flow Contingency Analysis
  - Post Transient Analysis
  - Post Transient Stability Analysis
  - Post Transient Voltage Deviation Analysis
  - Voltage Stability and Reactive Power Margin Analysis
  - Transient Stability Analysis

Corrective Action Plans

- The technical studies mentioned in this section will be used for identifying mitigation plans for addressing reliability concerns.
- As per ISO tariff, identify the need for any transmission additions or upgrades required to ensure System reliability consistent with all Applicable Reliability Criteria and CAISO Planning Standards.
  - In making this determination, the ISO, in coordination with each Participating TO with a PTO Service Territory and other Market Participants, shall consider lower cost alternatives to the construction of transmission additions or upgrades, such as:
    - acceleration or expansion of existing projects,
    - demand-side management,
    - special protection systems,
    - generation curtailment,
    - interruptible loads,
    - storage facilities; or
    - reactive support

Unified Planning Assumptions & Study Plan
2016-2017 ISO Local Capacity Requirement Studies

Catalin Micsa

Senior Advisor Regional Transmission Engineer

2016-2017 Transmission Planning Process Stakeholder Meeting

February 29, 2016

Existing ISO Local Capacity Requirement (LCR) Areas and OTC Plants

Summary of LCR Assumptions

- Assumptions consistent with ISO Reliability Assessment
  - Transmission (approved by ISO Board of Governors and ISO Management) and generation modeled if on-line before June 1 for applicable year of study (January 1 for Humboldt – winter peaking)
  - Use the latest CEC 1-in-10 peak load in defined load pockets
    - CEC Mid forecast
    - CEC Low-Mid AAEE
  - Maximize import capability into local areas
  - Maintain established path flow limits
  - Units under long-term contract turned on first
  - Maintain deliverability of generation and imports
  - Fixed load pocket boundary
  - Maintain the system into a safe operating range
  - Performance criteria includes normal, single as well as double contingency conditions in order to establish the LCR requirements in a local area
  - Any relevant contingency can be used if it results in a local constraint
  - System adjustment applied (up to a specified limit) between two single contingencies

LCR Criteria

- The LCR study is a planning function that currently forecasts local operational needs one year in advance

- The LCR study relies on both:
  - ISO/NERC/WECC Planning Standards
  - WECC Operating Reliability Criteria (ORC)

- Applicable Ratings Incorporate:
  - ISO/NERC/WECC Planning Standards – Thermal Rating
  - WECC ORC – Path Rating

Near-term Local Capacity Requirement

Scope plus Input Assumptions, Methodology and Criteria

The scope of the LCR studies is to reflect the minimum resource capacity needed in transmission constrained areas in order to meet the established criteria.

For latest study assumptions, methodology and criteria see the October 29, 2015 stakeholder meeting. This information along with the 2017 LCR Manual can be found at: http://www.caiso.com/informed/Pages/StakeholderProcesses/LocalCapacityRequirementsProcess.aspx.

Note: in order to meet the CPUC deadline for capacity procurement by CPUC-jurisdictional load serving entities, the ISO will complete the LCR studies approximately by May 1, 2016.

General LCR Transparency

- Base Case Disclosure
  - ISO has published the LCR base cases on the ISO Market Participant Portal

  (https://mpp.caiso.com/tp/Pages/default.aspx)
    - Access requires WECC/ISO non-disclosure agreements

      (http://www.caiso.com/1f42/1f42d6e628ce0.html)
- Publication of Study Manual (Plan)
  - Provides clarity and allows for study verification

  (http://www.caiso.com/Documents/2017LocalCapacityRequirementsFinalStudyManual.pdf)
- ISO to respond in writing to questions raised (also in writing) during stakeholder process

  (http://www.caiso.com/informed/Pages/StakeholderProcesses/LocalCapacityRequirementsProcess.aspx)

Near-term LCR Study Schedule

CPUC and the ISO have determined overall timeline

- Criteria, methodology and assumptions meeting Oct. 29, 2015
- Submit comments by November 12, 2015
- Posting of comments with ISO response by the December 1, 2015
- Base case development started in December 2015
- Receive base cases from PTOs January 3, 2016
- Publish base cases January 15, 2016 – comments by the 29th
- Draft study completed by March 26, 2016
- ISO Stakeholder meeting March 21, 2016 – comments by the 4th
- ISO receives new operating procedures April 4, 2016
- Validate op. proc. – publish draft final report April 7, 2016
- ISO Stakeholder call April 14, 2016 – comments by the 21th
- Final 2017 LCR report April 29, 2016

Longer-term Local Capacity Requirement

Longer-term Local Capacity Requirement

- Based on the alignment of the ISO transmission planning process with the CEC Integrated Energy Policy Report (IEPR) demand forecast and the CPUC Long-Term Procurement Plan (LTPP) proceeding, the long-term LCR assessment is to be evaluated ***every two years.***
- The 2014-2015 transmission planning process is the first year in which all LCR areas within the ISO BAA were evaluated for long-term assessment.
- The 2016-2017 transmission planning process is the next planning process in which all LCR areas will be evaluated for long-term needs.

Study Scope, Input Assumptions, Methodology and Criteria

- Similar to the Near-term Local Capacity Requirement (LCR) assessment (http://www.caiso.com/Documents/Local%20capacity%20requirements%20process%20-%20studies%20and%20papers)
- Long-Term Capacity Requirement studies focus on determining the minimum capacity requirements within each of the local areas
  - Scenario: local capacity requirement studies will be performed for the longer-term of the planning horizon
  - Updated CPUC base portfolio for the 33% Renewable Portfolio Standards will be included in the study cases
    - Future assumptions for 50% RPS will be incorporated in future planning cycles upon recommendation from the CPUC

Resource Retirements and Additions Assumptions

- The same as the Reliability Assessment Requirements
- The ISO will utilize the State Water Resources Control Board (SWRCB)'s compliance schedule for assumptions on OTC generation
- Generating resources that are in service for forty years or older will be retired
- For Southern California local capacity area reliability assessment, the amounts approved by the CPUC from the Long Term Procurement Plan (LTPP) Tracks 1 and 4 Decisions will be studied
  - Specific resource procurements that have received the CPUC-approved Power Purchase Tolling Agreements (PPTAs) will be modeled in the study cases based on its latest estimates of in-service dates;
- For potential residual procurement needs, the ISO will utilize inputs from the CPUC's Assumptions & Scenario for the 2016-2017 ISO Transmission Planning Process and from the Load Serving Entity's consideration, up to but not exceeding the maximum CPUC authorizations

Potential Mitigations for Considerations

- Additional preferred resources (i.e., EE, DR or renewables) and/or energy storage
- Long-term transmission options, including potential new transmission facilities (i.e., lines, transformer, voltage support devices)
- Conventional resources

Unified Planning Assumptions & Study Plan
Special Studies

Robert Sparks
Jeff Billinton
Managers- Regional Transmission

2016-2017 Transmission Planning Process Stakeholder Meeting
February 29, 2016

Special Studies

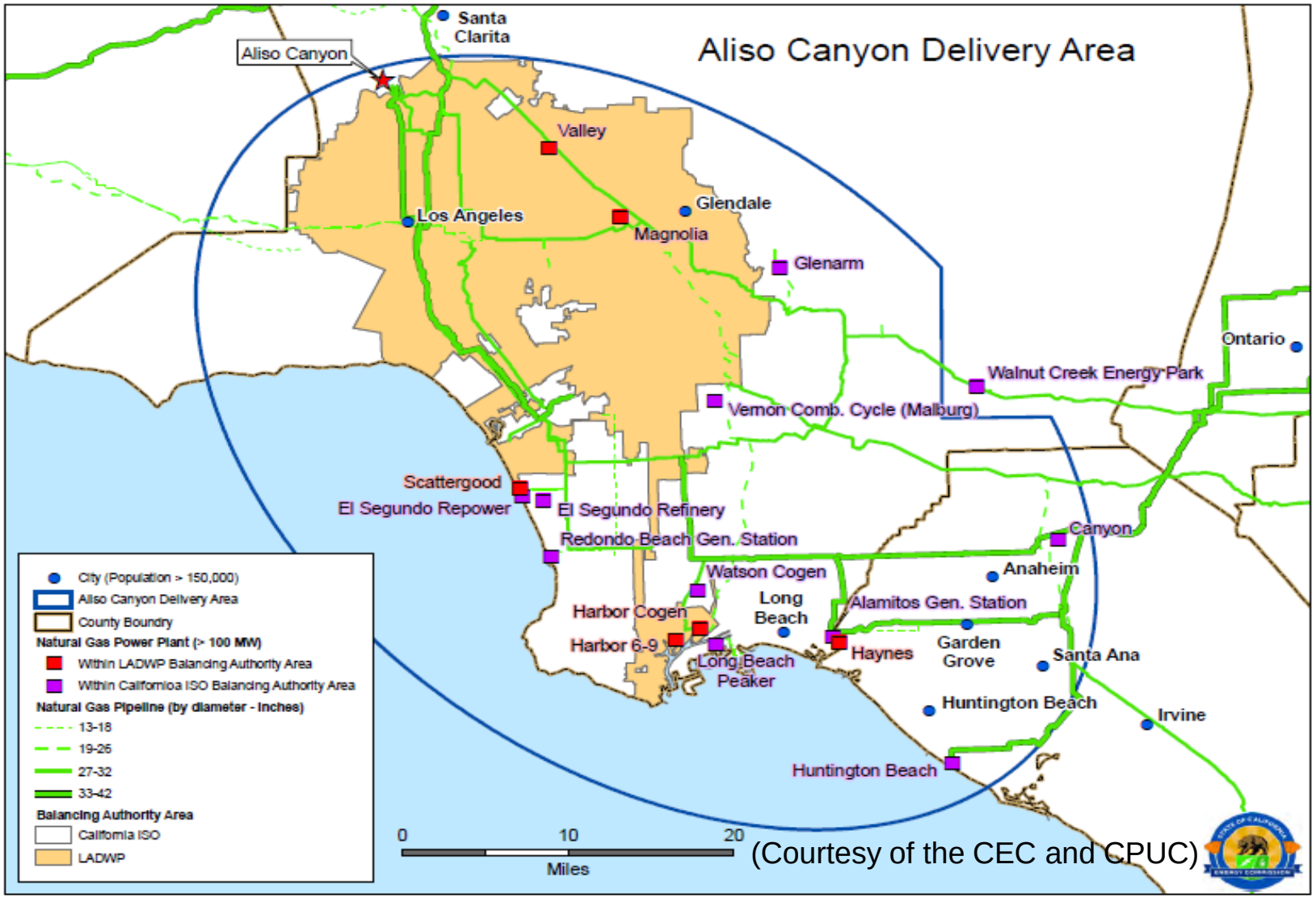
- Gas-Electric Coordination
- Required Performance Characteristics for Slow Response Local Capacity Resources
- 50 % Renewable Generation
- Frequency Response – Generation Modeling
- Potential for Economically-Driven Retirement of Gas Generationi

Gas-Electric Coordination Transmission Planning Studies

Gas – Electric Coordination in Transmission Planning Reliability Studies

- The 2015-2016 TPP, the ISO performed electric system studies for the LA Basin and San Diego areas involving:
  - gas curtailments under adverse winter conditions
  - a major gas transmission line outage
- However, in late 2015 operability of the Aliso Canyon storage field was lost
- Additional electric system studies for the LA Basin and San Diego areas involving the loss of operability of Aliso Canyon will be included in this planning cycle

The SoCal Gas System



(Courtesy of the CEC and CPUC)

Current efforts are focusing on the more immediate operational situation

- In the aftermath of the Aliso Canyon gas leak incident, a Joint Agency Coordination Committee was created to evaluate immediate operational impacts
- In this planning cycle, the ISO will utilize the findings and recommendations from these operational studies as inputs for the long-term grid reliability assessment for the affected areas under similar gas storage unavailability conditions
- The ISO is considering expanding the scope of the study to include other local areas relying on gas storage facilities

Required Performance Characteristics for Slow Response Local Capacity Requirements

NERC and ISO's planning standards for P6 Events

- ISO must maintain local capacity reliability under NERC Planning Event 6 (P6, formerly Category C) contingencies
- Requires sufficient capacity to readjust the system to prepare for the loss of a second transmission element (N-1-1)

System must be repositioned within 30 minutes

- Based on requirement to reposition the system within 30 minutes, the ISO has two options:
  1. By assessing the system and issuing a dispatch instruction and have a response within 20 minutes*
  2. By dispatching a resource pre-contingency so as to have sufficient energy available
- The ISO has consistently applied these standards in its Local Capacity Technical Studies
  - ISO recently issued a clarification to its BPM providing additional details regarding these study parameters

* 10 minutes is used at beginning of contingency. If resources do not respond, the ISO will not meet reliability requirement

Option 2: Precontingency dispatch of slow response resources

- The ISO has received requests for more details about the required characteristics for the slow response resources
  - how often they could they be called upon
  - Duration of calls or how much energy do they need to "have behind them"
- Ideally there would be one requirement for the entire ISO footprint
- These requirements are expected to vary from one local area to the next depending on the specifics of each area's needs
- Need to strike a balance between varying specific requirements and providing more helpful general information

50% Renewable Special Study

2015-2016 Transmission Planning Process Summary

- ISO conducted initial 50% renewable generation
  - Studies based upon portfolios provided by CPUC

- Transmission capability estimates for the all the zones appeared to be reasonable for developing future portfolios for additional transmission studies

- CAISO is continuing to work with the CPUC to incorporate the following into the RPS calculator
  - Refinements to transmission capability estimates
  - Specific delivery points for resources in zones which resulted in widespread local reliability issues

2016-2017 Transmission Planning Process

- Detailed scope will consider:
  - CPUC's decisions regarding the next steps for the RPS calculator;
  - study objectives; and
  - consideration of the results of 2015-2016 TPP special study

- The assessment will consider the potential impact of transmission related curtailment on conventional generation

2016-2017 Transmission Planning Process (continued)

- Focus on evaluating the impact of out-of-state renewable resources on the reliability performance and curtailment of renewables.

- Will provide a framework for considering interregional transmission proposals emerging through the interregional coordination processes developed in compliance with FERC Order No. 1000, which is being initiated in the first quarter of 2016.
  - At this time, the bulk of interregional proposals that have been brought to the ISO's attention for possible future consideration focused on accessing out of state resources.

2015-2016 Transmission Planning Process Schedule

- Perform the special study starting end of August
  - after the completion of the reliability planning studies and during the period when the TPP typically assesses the need for public policy-driven transmission.

- Present preliminary results of the special study for discussion with stakeholders in the November stakeholder meeting

- Incorporate results into draft 2016-2017 Transmission Plan in January 2017

Frequency Response – Generator Modeling

2014-2015 & 2015-2016 Transmission Planning Process

- ISO conducted initial studies into frequency response and headroom requirements for potential over-supply conditions.

- The study results indicated:
  - acceptable frequency performance within WECC;
  - the ISO's frequency response may fall below the ISO frequency response obligation specified in NERC reliability standard BAL-003-1.

2014-2015 & 2015-2016 Transmission Planning Process (continued)

- Compared to the ISO's actual system performance during disturbances
  - study results seem optimistic
  - actual frequency responses for some contingencies were lower than the dynamic model indicated

- Further model validation is needed to ensure that governor response in the simulations aligns with the actual response on the system.

2016-2017 Transmission Planning Process

- ISO will assess within the 2016-2017 planning cycle:
  - the validation of models based on real-time contingencies; and
  - work with the facility owners to update the models as required
- The ISO will provide updates on the progress of this assessment through the 2016-2017 transmission planning process.

Potential for Economically-Driven Retirement of Gas Generation

Background

- There is a potential for the economically-driven early retirement of gas generation as a result of the increasing levels of renewable generation interconnecting to the electrical grid.

Study Approach

- The special study will:
  - develop a methodology for developing potential early retirement scenarios; and
  - assess the early retirement scenarios to identify if there are any reliability impacts associated with the early retirement of gas generation on the ISO controlled grid.

Unified Planning Assumptions & Study Plan
Economic Planning Studies

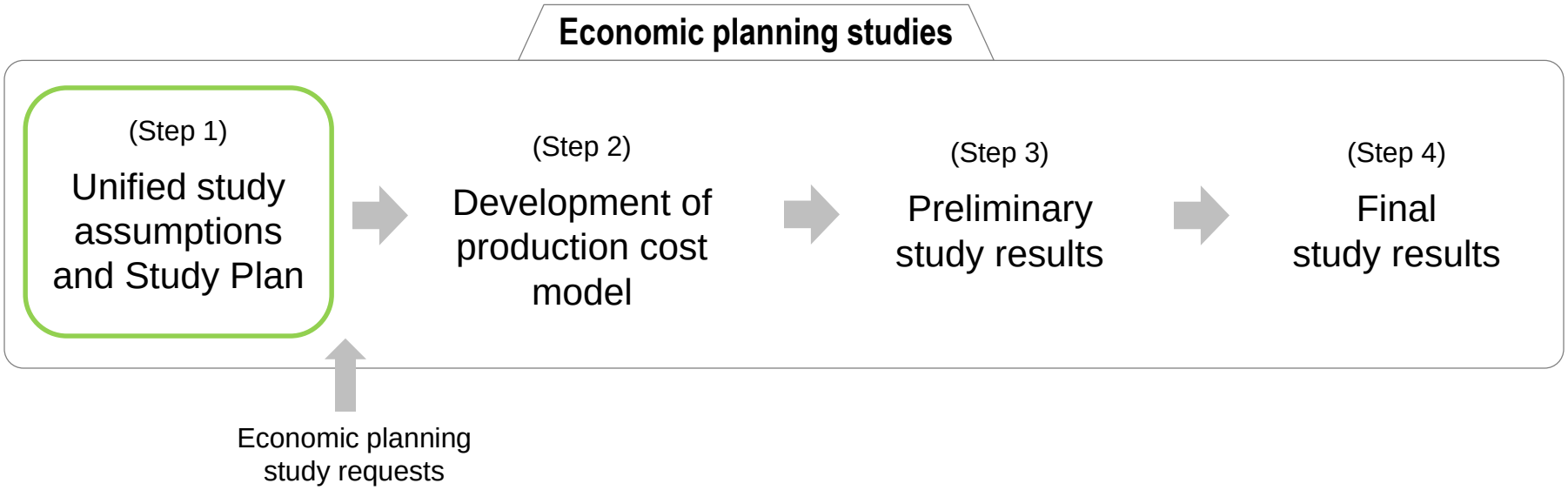
Yi Zhang

Regional Transmission Engineer Lead

2016-2017 Transmission Planning Process Stakeholder Meeting

February 29, 2016

Steps of economic planning studies



Economic planning study

- Database development for production cost simulation
- Congestion analysis based on production cost simulations on years 2021 and 2026
- Evaluation of economic study requests
- Selection of high priority studies
  - Rank congestions by severity
  - Consider economic study requests
  - Determine high priority studies
- Assessment for high priority studies

Assumptions for database development – base case

- TEPPC 2026 CC as the starting point (is scheduled to be available by the end of March, 2016)
- Update load, natural gas and GHG prices based on the latest CEC forecasts if different from TEPPC CC
- 33% RPS renewable portfolio from CPUC
- Generation retirement consistent with TPP reliability assumption
- All approved transmission projects
- Transmission constraints based on reliability, policy, and LCR study results
- Other updates reflecting market and grid operations

Economic planning study requests

- Economic Planning Study Requests are to be submitted to the ISO during the comment period of the draft Study Plan

- The ISO will consider the Economic Planning Study Requests as identified in section 24.3.4.1 of the ISO Tariff

Questions/Comments?

Next Steps

Chris Mensah-Bonsu
Lead Regional Transmission Engineer

2016-2017 Transmission Planning Process Stakeholder Meeting
February 29, 2016

Next Steps – Major Milestones in 2016-2017 TPP

Date	Milestone
Phase 1	
February 29 – March 14, 2016	Stakeholder comments and economic planning study requests to be submitted to regionaltransmission@caiso.com
March 31, 2016	Post Final 2016-2017 Study Plan
Phase 2	
August 15, 2016	Post Reliability Results
August 15 - October 15, 2016	Request Window
September 21 – 22, 2016	Stakeholder Meeting – Reliability Results and PTO proposed mitigation
November 16, 2016	Stakeholder Meeting – Policy and Economic Analysis
January 2017	Post Draft 2016-2017 Transmission Plan
February 2017	Stakeholder Meeting – Draft 2016-2017 Transmission Plan
End of March 2017	Post Final 2016-2017 Transmission Plan